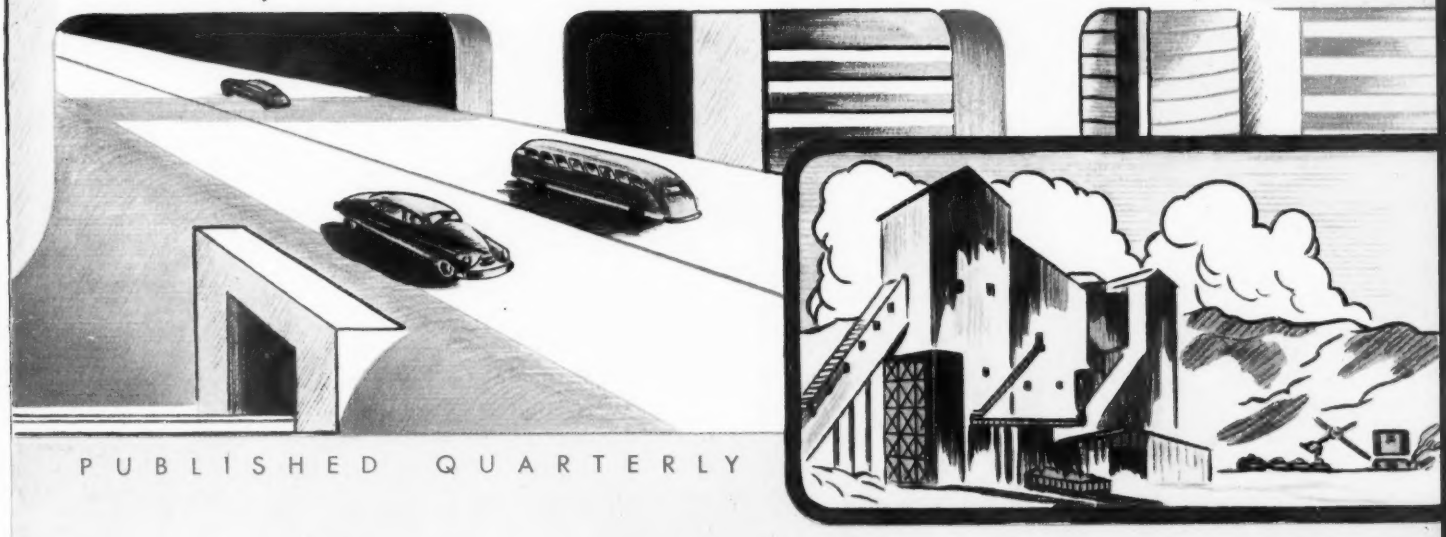
The CRUSHED STONE JOURNAL



PUBLISHED QUARTERLY

In This Issue

December 1951

- **Unprecedented Attendance Anticipated in Chicago**
- **Control of Hot-Mix Asphaltic Concrete**
- **Crushed Stone Output in 1950**

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of the
National Crushed Stone Association

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Manual of Uniform Cost Accounting Principles and Procedure for the Crushed Stone Industry (*$2.00 per copy*)

The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

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Do Not Delay

MAKE RESERVATIONS TODAY!

35th Annual Convention

and

Manufacturers Division Exposition

NATIONAL CRUSHED STONE ASSOCIATION

The Conrad Hilton • Chicago
February 18, 19, and 20, 1952

THE CRUSHED STONE JOURNAL

WASHINGTON, D. C.

Vol. XXVI No. 4 PUBLISHED QUARTERLY DECEMBER 1951

Unprecedented Attendance Anticipated in Chicago

A RECORD-BREAKER—that's a certainty for the 35th Annual Convention of the National Crushed Stone Association to be held at The Conrad Hilton, Chicago, on February 18, 19, and 20, 1952.

The Manufacturers Division Exposition held in even years in conjunction with the Annual Convention will substantially exceed the astonishing record set in Chicago in 1950, with space requirements now exceeding those for the show of two years ago by some three thousand square feet. Further, the number of exhibitors participating has reached a new high, guaranteeing to all in attendance the unparalleled opportunity of viewing firsthand the most comprehensive and complete display of machinery, equipment, and supplies ever brought together under one roof. To permit the hundreds of quarry operators who will be in attendance ample opportunity to get the greatest possible benefit from a careful and thorough inspection of the various exhibits, two full convention sessions—Monday afternoon and Wednesday morning—will be devoted exclusively to this purpose.

We do not loosely use the expression "hundreds of quarry operators." The advance registration cards being filed daily in the Washington office of NCSA, coupled with information received from The Conrad Hilton as to advance room reservations, give urgency to our suggestion that reservations should be made immediately, if not already attended to. Should you have overlooked this important detail, by all means come anyway, for you are assured of accommodations in the World's largest hotel, but obviously advance notice will give your request preferred consideration.

Now for a brief review of some of the features which are bound to make the trip to Chicago the best investment you can make in 1952.

Answers to Your Operating Problems

The entire Tuesday morning session will be devoted to "shop-talk" under the able Chairmanship of Dexter Bullard, Vice President in Charge of Operation for the New York Trap Rock Corporation. The presentation will be in the form of a panel discussion. A special committee gave much thought to the selection of the subjects, which it is felt certain are of universal appeal. E. F. Haberkern, Production Manager of the Columbia Quarry Company of St. Louis, Missouri, will discuss "Drilling Practices"; T. C. Cooke, President of the Lynn Sand and Stone Company of Swampscott, Massachusetts, will handle "Primary Blasting Practices"; and that increasingly important subject, "Quarry Safety Practices", will be presented by C. A. Gustafson, Superintendent of the Callanan Road Improvement Company of South Bethlehem, New York. As will be recalled, Mr. Gustafson is Editor of the Accident Review, currently being issued by the National Crushed Stone Association.

Following each presentation, a full half hour is permitted for questions, with thirty minutes also allowed at the end of the morning session for such general discussion as may develop. Each of the speakers at this session is preeminently qualified to handle his subject—and in such manner as to stimulate the best possible floor discussion.

Salesmen, Please Note

There will be presentations of very real interest to salesmen who attend the Chicago convention. Dealing with the subject of selling in its broadest

sense, we may expect a dynamic and inspirational address from Robert A. Whitney, President of National Sales Executives, Inc., of New York City. Mr. Whitney's fame has spread far and wide and a real treat is in store for those who have the privilege of hearing him in Chicago.

Two semi-technical papers are scheduled for presentation, which should be of real value to crushed stone salesmen: On Tuesday afternoon, Commander Charles M. Noble, Chief Engineer of the New Jersey Turnpike Authority, will present a paper entitled "The New Jersey Turnpike Pavement—Design and Construction." On Wednesday afternoon, Robert H. Nesbitt, Geologist, Office of the Chief of Engineers, Department of the Army, will give an illustrated talk entitled, "The Microscope and Aggregate Behavior."

Governmental Controls

Many are the difficulties encountered by business executives during a period of governmental controls imposed by the mobilization program. While such difficulties cannot of course, be eliminated, much can be done to assist company executives in the operation of their businesses in harmony with the controls. Definitely aimed in this direction are a number of features on the program which should especially appeal to the executive.

Wage and salary controls will be discussed by William F. Howe, of Gall, Lane and Howe, Counsel for the National Crushed Stone Association. Much of the material which has been sent to members during the course of the year on this important subject has been prepared by Mr. Howe, and it is especially appropriate that the membership be given the opportunity to meet him. In addition, there are probably few, if any, men in the country better informed on this most complicated subject. The major responsibility of every company executive is to keep the plant going, and this may be increasingly difficult during 1952 when a further squeeze on MRO and major capital additions is expected. Harold A. Montag, Director of the Mining Division of the Defense Materials Procurement Administration, Washington, D. C., will give us the latest information as to the outlook for 1952.

Also during the coming year, it may be anticipated that many problems will exist with respect to price control. With the first steps taken to develop a "tailored" price order for the crushed stone industry, Walter H. Acheson, Chief of the Building Materials Branch of the Office of Price Stabilization, Washington, D. C., should be able to tell us as to the progress made in the development of a "tailored" order and very possibly as to its essential characteristics.

Social Features

Many will be the opportunities provided throughout the convention period for relaxation and enjoyment. For the traditional Greeting Luncheon on Monday, the luncheon address will be given by Dr. William H. Alexander, Pastor of the First Christian Church, Oklahoma City, Oklahoma. It will be recalled that this Oklahoma City Clergyman shattered political precedent in his traditionally Democratic state by polling 285,000 running as the Republican candidate for the United States Senate in the election in 1950. Dr. Alexander is one of the most dynamic, able, and inspiring speakers on the platform today, and we are most fortunate in having him for our convention.

Following the inspection of the Manufacturers Division Exposition on Monday afternoon, there will be a Cocktail Party and Buffet Dinner. This increasingly popular affair brings together all in attendance at the Convention for the specific purpose of having a good time. Scheduled to conclude about 8:30 o'clock, the remainder of the evening is left free for each to follow his own particular desire.

The Luncheon on Wednesday should attract an unusually large attendance to hear Samuel Grafton address us on the intriguing subject "Who Owns the Future?". Specializing on national issues with particular emphasis on the domestic effect of foreign problems, Mr. Grafton will give us a trenchant analysis of the issues of the day. For ten years, conductor of the column "I'd Rather Be Right," frequently a contributor to *Colliers, Cosmopolitan,* and other magazines, and author of "All Out" and "An American Diary," Mr. Grafton is obviously well qualified to give us an intensely interesting and fascinating address.

Climaxing the three-day Convention period, devoted largely and properly to serious matters, we come to Wednesday evening and the Annual Banquet, where the aim is to give you the best possible in good, wholesome fun. If you want to be uproariously entertained (and who doesn't?) this highlight of the Convention program you just must attend, and Jimmy Arrington is the reason. He enjoys the distinction of being the former Mayor of Collins, Mississippi, and the Editor of the *News-Commercial*

(*Continued on Page 12*)

Control of Hot-Mix Asphaltic Concrete[1]

By J. ROGERS MARTIN

Research Professor, School of Civil Engineering
Oklahoma Institute of Technology
Oklahoma Agricultural and Mechanical College
Stillwater, Oklahoma

In non-technical language the author reviews principles of asphalt pavement design and discusses the more important factors essential to a good quality job.

THE first hot-mix asphalt pavement using petroleum asphalt was laid on Pennsylvania Avenue in Washington, D. C., in 1900. This sheet asphalt pavement was controlled strictly by trial and error, and incidentally, was a complete failure because the asphalt content was too high. From this beginning, more and more hot-mix pavements were laid with a constant improvement in the finished product. As time progressed, engineers, still working largely by trial and error, learned by hard experience the importance of asphalt content, of grading, and many other factors which contributed toward a successful pavement.

These early engineers were artists. Many of them learned to build good asphalt pavements by the same method that grandma baked a cake. Her units of measure were dashes, dabs, and pinches and she could bake a wonderful cake, but when she tried to tell daughter how to do it, the cake usually had to be thrown to the hogs. So it was with these old veteran asphalt men.

In the '20's a new breed began to emerge in the asphalt paving industry known as the laboratory research man. He followed the veteran around, observing his methods and analyzing his pavements with the objective of finding the keys and establishing rules for building a good pavement so that it would not be necessary for a man to have fifty years' experience in order to place one which was satisfactory. In this he was largely successful. Guiding principles were discovered and put into use through tests and specification requirements. They were called controls. Now from where did these controls come? They were not the result of so-called research men sitting at a desk and determining out of thin air just what would have to be done to make a good pavement. They were merely the reflection of the skill of the veterans in the field reduced to definite figures and numbers. As a matter of fact, a statement of the principles of control and design could aptly be considered as a summary report of fifty years of field research in building hot-mix asphalt pavements.

Principles Summarized

Now let us see what these principles are. Inasmuch as control is merely the design worked in reverse, let us consider the guiding principles in design which have now been agreed upon by the major portion of the engineers in this country.

(1) The aggregate must be reasonably well graded. For instance, the commonly used mixes for surface course must have sizes all the way from about 1/2 in. down to dust.

(2) Finished pavements must have a certain amount of air included in the mix in the form of air pockets or voids. Experience has shown that the voids should not exist in an amount of less than 2 per cent nor more than about 6 per cent. So taking the middle course, the designer sets the voids at 4 per cent or, stated in another manner, he sets the mix at 96 per cent density. This is accomplished by making up several mixes in the laboratory with varying per cents of asphalt, compacting them as they will be compacted on the road and then selecting the asphalt content which will give 96 per cent density. Thus, the optimum asphalt content of the mix is established.

(3) Having decided on the exact grading and the exact asphalt content to be used, it is now necessary that the compacted mix be tested by some stability method to determine whether or not it will take the traffic to which it will be subjected.

(4) The use of extremely hard asphalts is avoided because the softer asphalts have a longer life. The old concept that the asphalt had to be as hard as a brick in order to obtain the necessary stability no longer prevails. It is now known that a much more important consideration in obtaining a strong stable pavement is the kind of aggregate employed in the mix. An illustration of this may be seen in Figure 1.

[1] This article is based upon a paper presented before the last meeting of Division No. 4, The Asphalt Institute, at Oklahoma City. Reprinted from *Bituminous Roads and Streets*, July 1951.

Figure 1 gives the design results of four different mixes. Each curve represents four different asphalt contents plotted against the per cent Hveem stabil-

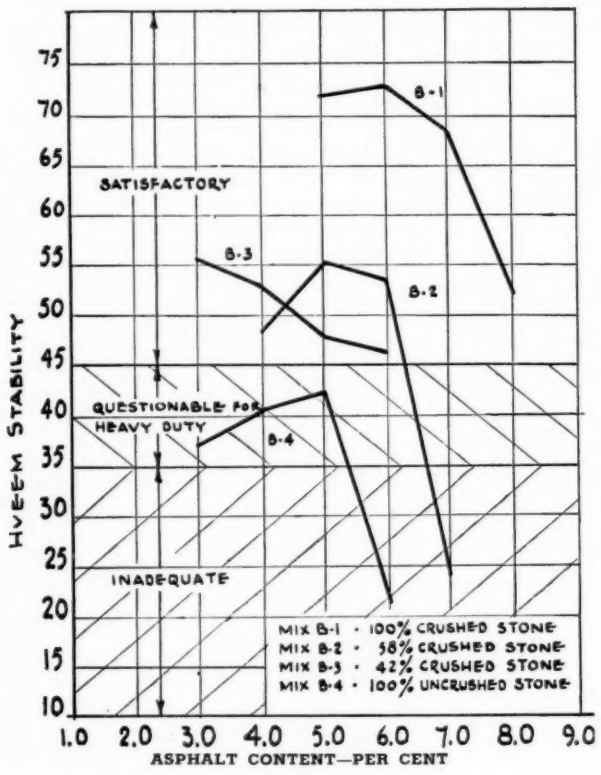

Figure 1
Effect of Type of Aggregate on Stability

ity. Any specimen, the results of which fall above the bottom hatched portion will have satisfactory stability for most purposes. In case of pavements subjected to heavy, frequently-stopping traffic, specifications usually require a minimum of 45 so that we may say that those above the second hatched portion are completely satisfactory for all pavements. Now each of these mixes has exactly the same grading but different types of stone were used in each case. Curve B-1 is 100 per cent crushed limestone, B-2 is 58 per cent crushed limestone and 42 per cent sand. Curve B-3 is 42 per cent limestone screenings and 58 per cent uncrushed gravel. B-4 has no crushed stone, consisting entirely of gravel and sand. Now you will observe that the stability of the mixes represented by each curve drops progressively lower as the per cent of crushed stone is decreased. Here is an important factor in any design. It would be an easy matter for the engineer to design a mix in accordance with the curve in B-1, 100 per cent limestone. There would be little fear of obtaining an unstable mix and he could "rest at nights." Now what about the contractor's standpoint on these mixes.

Cost vs. Stability

As a general rule, we can say that stability costs money because the price of the aggregates usually decreases as the stability decreases. For instance, on this particular set of designs we have plotted material cost based on 100 per cent for the all-crushed mix against the Hveem stability. This is shown in Figure 2. The use of mix B-2 will save 12 per cent on the material cost over that for mix B-1. Mix B-3 will effect a savings of 17 per cent and B-4 a savings of 24 per cent.

The curves in Figure 1 are very typical of the trend reflected in mixes with varying amounts of crushed stone, but it should be pointed out that the mix containing no crushed stone showed a little higher stability than can normally be expected. Figure 3 represents a series of curves which are more typical of those ordinarily obtained.

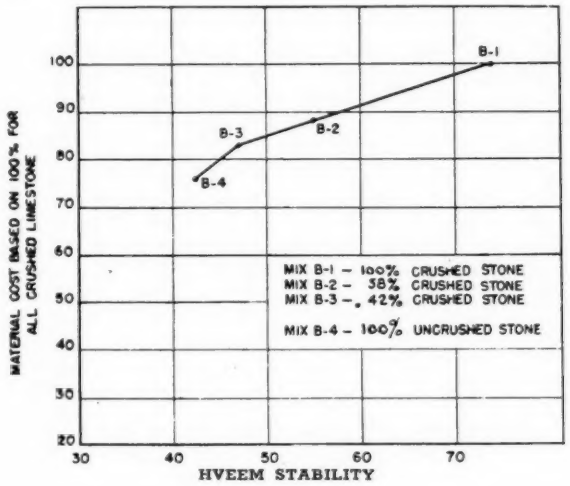

Figure 2
Relation of Material Cost to Hveem Stability

Curve (2), Figure 3, is fairly representative of many of the mixes being used in Oklahoma employing crushed stone and sand. Also, curve (3) is fairly typical of what is to be expected with little or no crushed stone in the mix.

The cost relation on these mixes are similar to those shown in the last figure so that curve (3) represents the cheapest mix by far. However, it is ob-

vious from this curve that this mix is unsatisfactory due to the narrow range of asphalt content over which it will have 35 per cent stability or more. This statement applies to the accuracy of control which we are actually able to obtain in the field as of 1950. At some future date when the contractor and engineer working together have perfected control to a fine point, such a mix can be used safely with a resultant savings in cost.

Now let us consider plant control on the job. Actually plant control is nothing more than a matter of seeing that the mix is made in accordance with the established design. Minimum tests are extraction, grading, and density tests. The extraction gives the asphalt content and the grading.

Importance of Gradation

I believe it is unnecessary to point out here the importance of holding the asphalt content within the design limits because every engineer and contractor

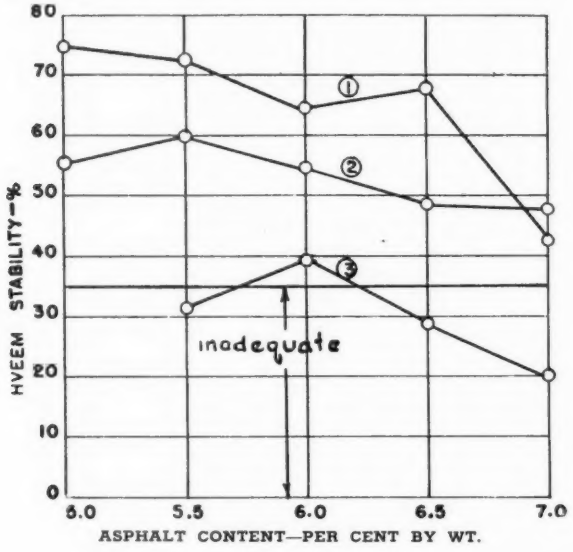

Figure 3
Aggregate Portions Contain: Curve 1, 100% Crushed Limestone; Curve 2, 60% Crushed Limestone and 40% Sand; Curve 3, 10% Crushed Limestone, 40% Uncrushed Gravel and 50% Sand

is familiar with the fact that an excess of asphalt will invariably result in shoving, bleeding, or rutting; whereas, a deficiency of asphalt invites raveling and loss of life of the pavement. However, I believe the average engineer and particularly the contractor underestimates the importance of close control of the grading. The most serious damage results when an excess of material from the fine bin is added.

In an effort to illustrate the results of this, we have prepared a series of mixes with various amounts of fine aggregate in the mix and determined the density and stability on each of them.

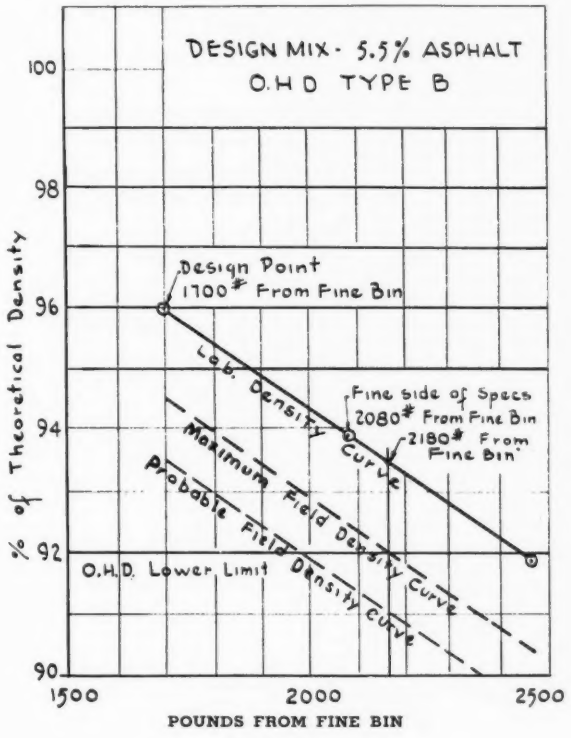

Figure 4
Effect of Grading on Per Cent Density

Figure 4 gives results of these mixes with pounds, from the fine bin, plotted against the per cent density for the mix on the basis of a 4000-lb. batch.

The design asphalt content of the mix is 5.5 per cent with an aggregate consisting of 55 per cent limestone and 45 per cent sand. It was estimated that it would require 1700 lb. from the fine bin.

The solid curve represents the densities obtained on the laboratory specimens, which were molded by the gyratory method. Under the most favorable conditions, the corresponding densities obtained in construction, immediately after rolling is complete, will rarely exceed the values represented by the dotted curve, "Maximum Field Density." Under average conditions the field density will approximate the values represented by the dotted curve, "Probable Field Density."

Now insofar as grading specifications are concerned, an extra 380 lb. (2080 lb. total) may be added from the fine bin without violating specifications, but what about the field density? The contractor can obtain the minimum of 92 per cent only with long and heavy rolling under ideal conditions. If an excess of more than 480 lb. (2180 lb. total) is added, he cannot obtain minimum field density by any amount of rolling.

Stability Also Lower

If reduction of field density were the only result of excess fine bin material, the matter might not be of great importance. However, it also results in a reduction of stability as shown by Figure 5. The

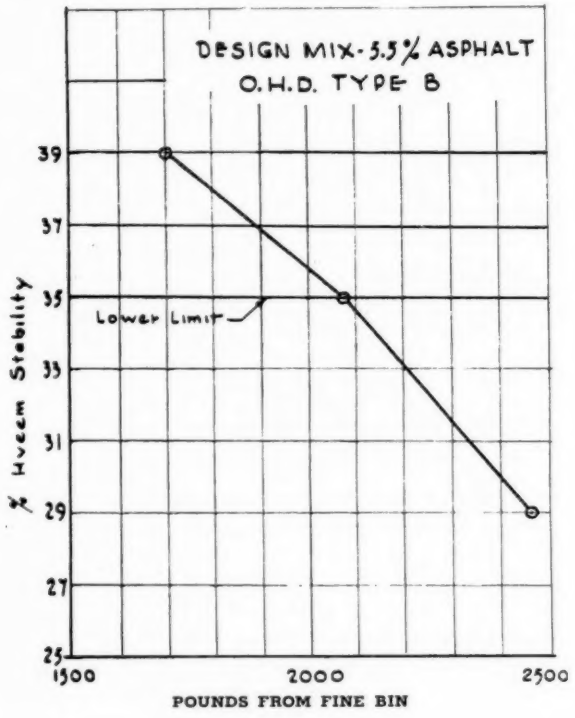

Figure 5
Effect of Grading on Stability

immediate effect of reducing the stability is manifested by increased difficulty in rolling the pavement out to the "pool-table-smooth" surface which came rather easily while the mix was being properly proportioned. This is because the mix becomes progressively "squashier" as the stability is reduced. The resultant weakening of the pavement to the resistance of traffic needs no discussion here.

Another factor in the plant control is the temperature. It is common knowledge that overheating of the asphalt or stone is not desirable and most specifications limit the temperature to 300 F. as the mix comes from the pug mill; however, I believe that this matter of keeping the temperature as low as possible is probably overworked in some cases. It should be remembered that an asphalt which is working satisfactorily at a given temperature, say 265 F. may not work satisfactorily when the weather cools off. Trying to work with a mix too cool is one cause of cracks appearing immediately behind the finisher and this should be taken into account. Also, it should be remembered that the temperature shown on the recording thermometer is not the governing temperature because there will usually be a drop of 15 to 20 F. between the end of the drier and the pug mill. The controlling temperature is that shown on a thermometer stuck into the mix after it has been placed in the truck.

Field Control Factors

So much for plant control. Assuming that plant control has been satisfactorily carried out in every detail, the pavement can still be a sore disappointment if the field control is inadequate. Among others, there are two outstanding points. (1) The material must be well compacted and (2) a pavement must be obtained that has a smooth surface without waves and irregularities. If the contractor makes an honest effort to obtain good compaction and has adequate rollers there will usually be no difficulty in meeting density requirements. As a general rule, a portion of a hot-mix pavement which will not come up to the density requirements can be detected without running a density test. Such places most commonly occur at an inaccessible point and they can be spotted by the observation of roller creasing and a little heel stomping. Of course, density tests are important and at least one per day should be run to ascertain that density requirements are being met, because it may be seen from some of the preceding discussion that inadequate density may result from causes other than inadequate rolling.

In the matter of obtaining a smooth surface, I am a strong believer in obtaining such a surface as early as possible. By this I mean a pavement laid over a gravel or a crushed stone base should not have the first course placed until the base is smooth and solid. If this is done, particularly with the use of the me-

(*Continued on Page 12*)

Crushed Stone Output In 1950*

By HENRY P. CHANDLER
NAN C. JENSEN

Under the Supervision of G. W. Josephson
Chief, Construction and Chemical
Materials Branch, Minerals Division
U. S. Bureau of Mines
Washington, D. C.

CRUSHED and broken stone production, as reported by producers to the Bureau of Mines, United States Department of the Interior, showed a substantial increase in the United States in 1950 over the 1949 output, it being 250,253,850 short tons valued at $332,117,914, an increase of 13 per cent in tonnage and 15 per cent in value. Included in this total are stone sold or used for concrete aggregates, railroad ballast, metallurgical use (flux), agricultural limestone, refractory stone, riprap, in alkali, calcium carbide, sugar and glass factories, in paper mills, and in various other chemical and manufacturing processes. Stone used in the manufacture of open-market lime and cement, asphaltic stone, and slate used for granules and flour are not included in this total.

The use of crushed and broken stone for concrete aggregate and railroad ballast (66 per cent of the total output in 1950) increased 17 per cent in quantity and 21 per cent in value over the 1949 totals. Commercial operators produced 89 per cent of the 147,107,670 short tons used for concrete aggregate, and government agencies 11 per cent.

Metallurgical uses, which took 14 per cent of the total crushed and broken stone in 1950 showed increases of 17 per cent in quantity and 18 per cent in value compared with 1949. Limestone for agricultural purposes (8 per cent of the total tonnage of crushed stone in 1950), decreased 10 and 9 per cent, respectively, in quantity and value. Other uses consumed 29,213,500 tons (12 per cent of total), valued at $53,979,034.

In 1950 limestone, including dolomite, constituted 72 per cent of all crushed and broken stone (excluding that used for making cement and lime) and was quarried in all but three states.

The following tables present the salient statistics of the crushed and broken stone industries in 1950.

*Mineral Market Report MMS No. 2036.

CRUSHED AND BROKEN STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1949–50, BY PRINCIPAL USES

Use	1949			1950		
	Short Tons	Value		Short Tons	Value	
		Total	Average		Total	Average
Concrete and road metal	124,367,210	$158,357,911	$1.27	147,107,670	$192,293,884	$1.31
Railroad ballast	17,054,180	15,376,880	.90	18,614,040	17,519,533	.94
Furnace flux [1]	[2] 30,752,320	[2] 32,267,642	[2] 1.05	35,969,820	37,932,388	1.05
Alkali works	6,022,240	5,641,705	.94	6,174,350	5,869,819	.95
Riprap	7,568,390	9,829,626	1.30	6,898,050	7,807,200	1.13
Agriculture [1]	21,482,910	33,251,141	1.55	19,348,820	30,393,075	1.57
Refractory stone [3]	[2] 1,827,630	[2] 5,764,355	[2] 3.15	2,158,000	5,848,591	2.71
Asphalt filler	671,560	1,893,964	2.82	750,050	2,777,973	3.70
Calcium carbide works	652,950	654,470	1.00	749,930	782,993	1.04
Sugar factories	555,030	1,361,169	2.45	717,620	1,608,097	2.24
Glass factories	621,840	1,373,314	2.21	769,680	1,720,504	2.24
Paper mills	417,850	766,856	1.84	431,940	942,439	2.18
Other uses	[2] 10,414,030	[2] 23,156,487	[2] 2.22	10,563,880	26,621,418	2.52
Total	222,408,140	289,695,520	1.30	250,253,850	332,117,914	1.33
Portland and natural cement and cement rock [4]	55,219,000	[5]	.....	59,361,000	[5]	.....
Lime [6]	12,637,000	[5]	.....	14,980,000	[5]	.....
Grand total	290,264,000	[5]	.....	324,595,000	[5]	.....

[1] Limestone
[2] Revised figure
[3] Ganister (sandstone), mica schist, dolomite, and soapstone
[4] Value reported as cement in chapter on Cement
[5] No value available for stone used in manufacture of cement and lime
[6] Value reported as lime in chapter on Lime

STONE[1] SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1949–50 BY STATES

State	1949		1950	
	Short Tons	Value	Short Tons	Value
Alabama	2,636,930	$6,039,867	2,587,500	$6,038,220
Arizona	356,050	203,295	228,490	139,810
Arkansas	[2] 1,279,250	[2] 2,247,236	3,952,720	7,419,110
California	11,373,700	12,594,048	11,764,630	13,998,432
Colorado	[2] 1,816,790	[2] 2,803,538	[2] 1,679,960	[2] 2,776,331
Connecticut	1,695,650	2,460,547	[2] 1,860,700	[2] 2,789,532
Delaware	37,240	92,100	77,050	190,113
Florida	4,215,090	4,748,253	5,313,400	6,885,394
Georgia	[2] 4,156,220	[2] 8,427,627	[2] 6,144,980	[2] 11,917,482
Idaho	1,440,680	1,878,801	[2] 644,020	[2] 861,290
Illinois	17,054,110	20,682,162	17,911,480	21,970,537
Indiana	[2] 6,332,360	[2] 15,227,818	6,994,670	20,686,160
Iowa	6,831,190	8,663,201	[2] 8,425,490	[2] 10,668,427
Kansas	[2] 5,978,420	[2] 7,951,490	7,630,300	8,920,207
Kentucky	7,100,160	8,586,402	[2] 7,417,200	[2] 8,865,913
Louisiana	(3)	(3)	(3)	(3)
Maine	258,810	2,025,870	[2] 309,740	[2] 2,214,164
Maryland	[2] 1,789,830	[2] 3,036,410	1,975,690	3,459,605
Massachusetts	2,290,940	6,552,935	[2] 3,284,470	[2] 8,484,999
Michigan	16,546,670	13,387,334	19,095,540	15,391,366
Minnesota	1,878,910	5,278,716	[2] 1,953,450	[2] 5,334,028
Mississippi	(3)	(3)	100,000	115,000
Missouri	9,562,720	13,969,008	10,300,400	14,406,627
Montana	[2] 602,890	[2] 563,465	919,090	949,545
Nebraska	[2] 504,870	[2] 840,758	[2] 736,660	[2] 1,042,035
Nevada	518,510	668,960	[2] 274,460	[2] 269,478
New Hampshire	6,910	381,141	[2] 15,760	[2] 383,667
New Jersey	4,070,790	7,896,619	[2] 4,672,050	[2] 9,119,251
New Mexico	138,290	106,135	364,930	243,841
New York	13,022,070	18,160,387	13,121,850	19,728,957
North Carolina	6,225,290	10,077,976	7,711,580	11,894,745
North Dakota	(3)	(3)	193,250	135,698
Ohio	[2] 19,364,230	[2] 27,419,158	20,466,350	28,628,678
Oklahoma	4,341,930	4,027,409	5,021,660	4,848,223
Oregon	[2] 4,397,390	[2] 6,479,164	[2] 3,836,550	[2] 5,559,010
Pennsylvania	21,226,480	34,855,664	25,493,230	42,205,691
Rhode Island	[2] 74,670	[2] 451,029	239,400	798,186
South Carolina	[2] 2,440,540	[2] 3,628,596	[2] 2,557,510	[2] 3,836,056
South Dakota	[2] 1,023,710	[2] 4,473,432	[2] 1,205,910	[2] 4,860,858
Tennessee	[2] 7,613,530	[2] 13,026,948	7,978,590	13,802,288
Texas	4,158,430	5,289,647	[2] 4,893,150	[2] 5,580,463
Utah	283,020	427,418	929,410	880,667
Vermont	441,770	8,276,287	447,310	8,038,892
Virginia	7,509,740	12,442,765	9,272,740	16,434,602
Washington	[2] 3,688,890	[2] 4,105,516	4,930,820	5,734,563
West Virginia	4,854,590	6,960,191	[2] 5,367,510	[2] 7,825,653
Wisconsin	7,326,710	13,636,020	6,999,630	14,494,750
Wyoming	1,802,580	2,227,096	1,841,400	2,214,037
Alaska, Hawaii, and Puerto Rico	1,477,820	1,999,329	1,268,810	2,671,559
Undistributed	2,279,200	6,163,877	1,701,560	4,867,957
Total	224,026,570	341,441,645	252,113,050	390,582,097

[1] Includes—1949: 1,618,430 short tons of dimension stone valued at $51,746,125; 1950: 1,859,200 tons, $58,464,183
[2] To avoid disclosing confidential information, certain State totals are incomplete, the figures not included being combined with "Undistributed"
[3] Included with "Undistributed"

CRUSHED STONE SOLD OR USED IN THE UNITED STATES IN 1950, BY METHODS OF TRANSPORTATION

Method of Transportation	Commercial Operations		Commercial and Non-Commercial [1] Operations	
	Short Tons	Per cent of Total	Short Tons	Per cent of Total
Truck	114,328,140	50	135,414,730	54
Rail	78,585,650	34	78,585,650	31
Waterway	25,013,170	11	25,013,170	10
Unspecified	11,240,300	5	11,240,300	5
	229,167,260	100	250,253,850	100

[1] Entire output of non-commercial operations assumed to be moved by truck

LIMESTONE (CRUSHED AND BROKEN STONE) SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1949–50, BY USES

Use	1949		1950	
	Short tons	Value	Short tons	Value
Riprap	2,806,230	$3,503,812	3,159,380	$3,559,662
Fluxing stone	[1] 30,752,320	[1] 32,267,642	35,969,820	37,932,388
Concrete and road metal	85,154,830	106,541,810	96,966,590	123,276,980
Railroad ballast	7,023,280	7,043,095	7,585,570	7,809,875
Agriculture	21,482,910	33,251,141	19,348,820	30,393,075
Alkali works	6,022,240	5,641,705	6,174,350	5,869,819
Calcium carbide works	652,950	654,470	749,930	782,993
Coal-mine dusting	284,840	1,130,061	341,170	1,320,342
Filler (not whiting substitute):				
Asphalt	671,560	1,893,964	750,050	2,777,973
Fertilizer	666,260	1,361,999	616,840	1,160,535
Other	257,540	974,509	294,180	1,178,761
Filter beds	56,020	100,741	89,020	158,205
Glass factories	621,840	1,373,314	769,680	1,720,504
Limestone sand	1,241,340	1,196,921	773,010	787,547
Limestone whiting [2]	501,400	3,511,159	676,410	4,875,667
Magnesia works (dolomite) [3]	241,070	428,723	236,480	409,852
Mineral food	413,850	1,837,105	463,050	2,252,857
Mineral (rock) wool	42,600	50,737	18,290	23,551
Paper mills	417,850	766,856	431,940	942,439
Poultry grit	101,980	904,053	95,100	893,298
Refractory (dolomite)	[1] 806,980	[1] 922,311	1,040,530	1,216,933
Road base	934,720	710,369	1,344,400	1,157,231
Stucco, terrazzo, and artificial stone	47,670	505,268	73,130	762,889
Sugar factories	555,030	1,361,169	717,620	1,608,097
Other uses [4]	589,290	926,608	1,031,270	1,550,805
Use unspecified	[1] 719,860	[1] 982,929	394,690	529,164
Total	163,066,460	209,842,471	180,111,320	234,951,442

[1] Revised figure
[2] Includes stone for filler for calcimine, caulking compounds, ceramics, chewing gum, explosives, floor coverings, foundry compounds, glue, grease, insecticides, leather goods, paint, paper, phonograph records, picture-frame moldings, plastics, pottery, putty, roofing, rubber, tooth paste, wire coating, and unspecified uses. Excludes limestone whiting made by companies from purchased stone
[3] Includes stone for refractory magnesia
[4] Includes stone for acid neutralization, athletic-field marking, carbon dioxide, chemicals (unspecified), concrete blocks and pipes, dyes, fill material, light bulbs, motion-picture snow, oil-well drilling, patching plaster, rayons, roofing granules, spalls, and water treatment

UNPRECEDENTED ATTENDANCE ANTICIPATED IN CHICAGO

(*Continued from Page 4*)

of the same town. Through his travels of over one hundred thousand miles a year, he has earned the reputation of one of the nation's most popular Convention speakers. Jimmy Arrington, for all his humor, is no clown. He has serious ideas and a good, old fashioned philosophy. Here is something decidedly different which we are sure you will long and enthusiastically remember.

Ladies' Entertainment

One of the gratifying developments in connection with the Annual Convention is the increasing number of ladies who attend. A large representation is expected in Chicago and plans are nearly completed to insure that they have a thoroughly enjoyable time while at our 35th Annual Meeting. Mrs. Harry A. Clark will serve as Hostess and detailed arrangements will be in the capable hands of Miss Josephine Mutter, who proved so helpful when we met in Chicago in 1950.

All Are Cordially Invited to Attend

All crushed stone producers and others interested in the crushed stone industry, whether or not members of the National Crushed Stone Association, are cordially invited to attend our 35th Annual Convention in Chicago on February 18, 19, and 20. A hearty welcome awaits you.

CONTROL OF HOT-MIX ASPHALTIC CONCRETE

(*Continued from Page 8*)

chanical finisher, the surface will pretty well take care of itself. I believe that men are few and far between who can operate the screws on a finisher to take out irregularities in the foundation. A much smoother course may be obtained by leaving the screws alone and throwing material back in the depressions and levelling off by raking the first course.

The fact that raking causes some segregation and an unsightly surface in the base course is without significance because the even surface it produces will make it unnecessary to do any raking in the surface course.

Highway Program Lags Under Controls

DESPITE the protests of highway transportation leaders from every corner of the nation, there seems to be little hope at this time that defense officials intend to revise their decisions on highway steel needs.

Meanwhile, highway construction and rehabilitation, especially in the more heavily populated areas, is steadily losing momentum.

First Quarter Increase

DPA Administrator Fleischmann recently informed a Senate committee that plans are underway to provide about a 5% increase in the highway steel allotment for the first quarter of 1951. This would add up to about 10,000 tons—2,500 of which would be critically needed structural steel.

In the opinion of competent road officials, this token increase is nothing more than a "drop in the bucket" of total highway steel requirements. Furthermore, the increase is said to be predicated upon the condition that, should it be made, the two-ton limitation on road projects which now can be self-certified will not be raised. Self-certification tonnage for certain other types of construction will be increased in the near future.

Allotments Go Unfilled

But totally inadequate allotments are not the only obstacles to elimination of road bottlenecks now confronting the state highway departments. The picture is further complicated by the fact that, even after an allotment has been officially authorized, road officials are having extreme difficulty in placing orders on steel mills and suppliers.

Mr. Fleischmann has said, repeatedly, that this situation stems from the newness of the Controlled Materials Plan and, as CMP procedures become firmly established, the full amount of authorized allotments should be realized. Thus, he declares, road officials will probably obtain most of the steel tonnage of about 201,000 tons authorized for the first quarter of 1952.—*Highway Highlights.*

Manufacturers Division—National Crushed Stone Association

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.
Crushing, Screening, Washing, Grinding, Cement Machinery; Motors; Texrope Drives; Centrifugal Pumps; Tractors

American Cyanamid Co.
Explosives Department
2527 Oliver Bldg., Pittsburgh 22, Pa.
Explosives and Blasting Supplies

American Manganese Steel Division
American Brake Shoe Co.
109 North Wabash Ave., Chicago 2, Ill.
Manganese Steel Castings, Power Shovel Dippers, Material Handling Pumps, Heat and Corrosion Resistant Castings, Reclamation and Hard-Facing Welding Materials

American Pulverizer Co.
1249 Macklind Ave., St. Louis 10, Mo.
Manufacturers of Ring Crushers and Hammermills for Primary and Secondary Crushing

American Steel & Wire Co.
Rockefeller Bldg., 614 Superior Ave., N. W., Cleveland 13, Ohio
Wire Rope, Aerial Wire Rope Tramways, Electrical Wires and Cables, Welded Wire Fabric, Concrete Reinforcing, Wire Nails, Fencing, Netting

Atlas Powder Co.
Wilmington 99, Del.
Industrial Explosives and Blasting Supplies

Austin-Western Co.
601 N. Farnsworth Ave., Aurora 1, Ill.
Jaw and Roll Crushers, Conveyors, Feeders, Screens, and Bins—Separately or Combined in Complete Crushing, Screening and Washing Plants; All Types of Dump, Hopper, and Quarry Cars, Air and Electrically Operated, in Narrow and Standard Gauges; Power Shovels, Drag Lines, and Cranes; Road Making, Earth Handling, and Street Cleaning Equipment

Bacon-Greene & Milroy
205 Church St., New Haven 10, Conn.
"FARREL-BACON" Jaw Crushers for Primary and Secondary Operations, Conveyors, Elevators, Rolls, Screens

Bacon-Pietsch Co., Inc.
149 Broadway, New York 6, N. Y.
Manufacturers of Farrel-Bacon Crushers and Allied Screening and Conveying Equipment

Baldwin-Lima-Hamilton Corp.
Lima-Hamilton Division
South Main St., Lima, Ohio
Power Shovels, Draglines and Cranes

Barber-Greene Co.
631 West Park Ave., Aurora, Ill.
Portable and Permanent Belt Conveyors, Belt Conveyor Idlers, Bucket Loaders both Wheel and Crawler Mounted, Asphalt Mixers and Finishers, Coal Handling Machines

Buchanan, C. G., Crushing Machinery Division of the Birdsboro Steel Foundry and Machine Co.
1941 Furnace St., Birdsboro, Pa.
Primary, Secondary, and Finishing Crushers and Rolls

Bucyrus-Erie Co.
South Milwaukee, Wis.
Excavating, Drilling and Material Handling Equipment

Buda Co.
154th St. and Commercial Ave., Harvey, Ill.
Diesel and Gasoline Engines; Material Handling Equipment; Lifting Jacks; Earth Drills and Maintenance of Way Equipment

Caterpillar Tractor Co.
Peoria 8, Ill.
Track-Type Tractors, Bulldozers, Earthmoving Scrapers, Motor Graders, Heavy-Duty Off-Road Hauling Units, Diesel Engines, and Diesel Electric Generating Sets

Chain Belt Co.
1600 W. Bruce St., Milwaukee 11, Wis.
Rex Conveyors, Elevators, Feeders, Idlers; Drive and Conveyor Chains, Power Transmission Equipment; Concrete Mixers, Pavers, Pumpcrete and Portable Pumps

Cincinnati Rubber Mfg. Co.
4900 Franklin Ave., Cincinnati 12, Ohio
Conveyor and Elevator Belting, Flat Transmission Belting, Chute Lining, All Types of Hose

Construction Equipment
205 East 42nd St., New York 17, N. Y.
"The Equipment Application Magazine"

Continental Gin Co.
Industrial Division
4500 Fifth Ave., S., Birmingham 2, Ala.
Conveyors—Belt, Screw, Flight, and Underground Mine; Elevators—Bucket and Screw; Feeders—Apron, Belt, Reciprocating, Table, and Screw; Drives—V-Belts, Chains and Sprockets, Gears and Speed Reducers

Manufacturers Division—National Crushed Stone Association
(continued)

Cross Engineering Co.
P. O. Box 16, Carbondale, Pa.
Screen Plates and Sections, Perforated Plate for Vibrating, Rotary and Shaking Screens

Cummins Engine Co., Inc.
Fifth and Union Sts., Columbus, Ind.
Lightweight Highspeed Diesel Engines (50-550 Hp.) for: On-Highway Trucks, Off-Highway Trucks, Buses, Tractors, Earthmovers, Shovels, Cranes, Industrial and Switcher Locomotives, Air Compressors, Logging Yarders and Loaders, Oil Well Drilling Rigs, Centrifugal Pumps, Generator Sets and Power Units, Work Boats and Pleasure Craft

Deister Machine Co.
1933 East Wayne St., Fort Wayne 4, Ind.
Deister Plat-O Vibrating Screen, Deister Compound Funnel Classifier

Detroit Diesel Engine Division General Motors Corp.
13400 West Outer Drive, Detroit 28, Mich.
Light Weight, Compact 2 Cycle Diesel Engines and "Package Power" Units for All Classes of Service

Diamond Iron Works, Inc.
1728 N. Second St., Minneapolis 11, Minn.
Jaw and Roll Crushers; Vibrator, Revolving, and Scrubber Screens; Drag Washers; Bucket Elevators; Belt Conveyors; Bins; Apron and Plate Feeders; Portable Gravel and Rock Crushing, Screening, and Washing Plants; Stationary Crushing, Screening, and Washing Plants; Hammermills

Du Pont, E. I., de Nemours & Co., Inc.
Wilmington 98, Del.
Explosives and Blasting Accessories

Eagle Iron Works
129 Holcomb Ave., Des Moines 13, Iowa
Fine Material Screw Washers—Classifiers—Dehydrators; Coarse Material Screw and Log Washers—Dewaterers; Water Scalping and Fine Material Settling Tanks; and "Swintek" Screen Chain Cutter Dredging Ladders

Easton Car and Construction Co.
Easton, Pa.
Off-Highway Transportation: Dump Trailers, Truck Bodies, and Cars for Mines, Quarries, and Earth Moving Projects

Ensign-Bickford Co.
Simsbury, Conn.
Primacord-Bickford Detonating Fuse and Safety Fuse

Euclid Road Machinery Co.
1361 Chardon Road, Cleveland 17, Ohio
Heavy-Duty Trucks and Dump Trailers for "Off-Highway" Hauls, Loaders for Earth Excavation

Even Spread Co.
P. O. Box 87, Owensville, Ohio
Power Spreaders and Attachments for Agricultural Lime and Fertilizer

Flexible Steel Lacing Co.
4607 Lexington St., Chicago 44, Ill.
Flexco HD Belt Fasteners, Alligator Belt Lacing, Flexco Hinged Belt Fasteners, Alligator Belt Cutters, Alligator Wide Belt Cutters, Alligator V Belt Fasteners, Flex V Belt Fasteners

Frog, Switch & Mfg. Co.
Carlisle, Pa.
Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches, and Crossings, Jaw and Gyratory Crushers, Cement Mills, Mining Machinery, Etc., Steam Shovel Parts

General Electric Co.
1 River Road, Schenectady 5, N. Y.
Electric Motors, Controls, Locomotives, Coordinated Electric Drives for: Shovels, Drag Lines, Conveyors, Hoists, Cranes, Crushers, Screens, Etc.; Coordinated Power Generating and Distributing Systems Including Turbine Generators, Switchgear, Transformers, Cable, Cable Skids, Load Center Substations

Gill Rock Drill Co.
Lebanon, Pa.
Well Drill Tools and Supplies

Goodrich, B. F., Co.
500 South Main St., Akron 18, Ohio
Industrial Rubber Products — Flexible Bonded Edge Conveyor and Elevator Belting, Cord Conveyor Belting, Highflex and Cord Transmission Belting; Grommet V-Belts; Type 54 Air Hydraulic Control, Burst Proof Steam, Water, Suction and Other Hose; Armorite Chute Lining; Rubber and Koroseal Protective Clothing and Footwear; Tires and Tubes (Automobile, Truck, Off-the-Road, Industrial), Batteries

Goodyear Tire & Rubber Co., Inc.
Akron 16, Ohio
Airfoam; Mechanical Goods—Belting (Conveyor, Elevator, Transmission), Hose (Air Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber); Rims (Truck and Tractor); Storage Batteries (Automobile, Truck, Tractor); Tires (Automobile, Truck, Off-the-Road); Tubes (Automobile, Truck, Off-the-Road, LifeGuard, Safety Tubes, Puncture Seal Tubes

Gruendler Crusher and Pulverizer Co.
2915 N. Market St., St. Louis 6, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammermills, Lime Pulverizers

Manufacturers Division—National Crushed Stone Association
(continued)

Gulf Oil Corp.
Gulf Refining Co.
Gulf Bldg., Pittsburgh 19, Pa.
Lubricating Oils, Greases, Gasoline and Diesel Fuels

Haiss, George, Mfg. Co., Inc., Division Pettibone Mulliken Corp.
141st-144th on Park Ave., New York 51, N. Y.
Bucket Loaders, Buckets, Portable and Stationary Conveyors, Car Unloaders

Harnischfeger Corp.
4400 W. National Ave., Milwaukee 14, Wis.
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators, Diesel Engines

HarriSteel Products Co.
420 Lexington Ave., New York 17, N. Y.
Woven Wire Screen Cloth

Hayward Co.
50 Church Street, New York 7, N. Y.
Orange Peel Buckets, Clam Shell Buckets, Electric Motor Buckets, Automatic Take-up Reels

Heidenreich, E. Lee, Jr., Consulting Engineers
67 Second St., Newburgh, N. Y.
Plant Layout, Design, Supervision; Open Pit Quarry Surveys; Appraisals—Plant and Property

Hendrick Mfg. Co.
Carbondale, Pa.
Perforated Metal Screens, Perforated Plates for Vibrating, Shaking, and Revolving Screens; Elevator Buckets; Test Screens; Wedge Slot Screens; Open Steel Floor Grating

Hercules Powder Co.
Wilmington 99, Del.
Explosives and Blasting Supplies

Hetherington & Berner Inc.
701-745 Kentucky Ave., Indianapolis 7, Ind.
Asphalt Paving Machinery, Sand and Stone Dryers, Dust Collectors

Hewitt-Robins Incorporated
370 Lexington Ave., New York 17, N. Y.
Belt Conveyors (Belting and Machinery); Belt and Bucket Elevators; Car Shake-outs; Feeders; Industrial Hose; Screen Cloth; Sectional Conveyors; Skip Hoists; Stackers; Transmission Belting; Vibrating Conveyors, Feeders, and Screens; Design and Construction of Complete Plants

Illinois Powder Mfg. Co.
506 Olive St., St. Louis 1, Mo.
Gold Medal Explosives

Ingersoll-Rand Co.
11 Broadway, New York 4, N. Y.
Rock Drills, Quarrymaster Drills, Jackbits, Bit Reconditioning Equipment, Portable and Stationery Air Compressors, Air Hoists, Slusher Hoists, Air Tools, Diesel Engines, Pumps

Insley Manufacturing Corp.
801 N. Olney St., Indianapolis 6, Ind.
Concrete Carts and Buckets, ½ Yd. Cranes and Shovels

International Harvester Co.
180 N. Michigan Ave., Chicago 1, Ill.
Motor Trucks, Diesel and Gasoline Power Units; Crawler Tractors; Industrial Wheel Tractors

Iowa Manufacturing Co.
916 16th St., N.E., Cedar Rapids, Iowa
Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Hot and Cold Mix Asphalt Plants, Stabilizer Plants, KU-BIT Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment, Hammermills

Jaeger Machine Co.
550 W. Spring St., Columbus 16, Ohio
Portable and Stationary Air Compressors, Self-Priming Pumps, Truck Mixers, Concrete Mixers, Road Paving Machinery, Hoists and Towers

Jaite Co.
Jaite, Ohio
Multiwall Paper Bags, Sewn and Pasted Style for Packaging Lime, Cement, Plaster, Etc.

Jeffrey Manufacturing Co.
E. First Ave., Columbus 16, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

Johnson-March Corp.
1724 Chestnut St., Philadelphia 3, Pa.
Dust Allaying Equipment

Joy Manufacturing Co.
333 Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Drills: Blast-Hole, Wagon, Rock, and Core; Air Compressors: Portable, Stationary, and Semi-Portable; Aftercoolers; Portable Blowers; Carpullers; Hoists; Multi-Purpose and Portable Rock Loaders; Air Motors; Trench Diggers; Belt Conveyors; Drill-Bit Furnaces; "Spaders"; "String-a-Lite" (Safety-Lighting-Cable); Backfill Tampers; Drill Bits: Rock and Core

Kennedy-Van Saun Mfg. and Eng. Corp.
2 Park Ave., New York 16, N. Y.
Crushing, Screening, Washing, Conveying, Elevating, Grinding, Complete Cement Plants, Complete Lime Plants, Complete Lightweight Aggregate Plants, Synchronous Motors, Air Activated Containers for Transportation of Pulverized Material, Cement Pumps, and Power Plant Equipment

Manufacturers Division—National Crushed Stone Association
(continued)

Kensington Steel Co.
505 Kensington Ave., Chicago 28, Ill.
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

Keystone Driller Co.
2001-2021 Eighth Ave., Beaver Falls, Pa.
Drills, Power Shovels

King Powder Co., Inc.
Cincinnati, Ohio
Detonite, Dynamites, and Blasting Supplies

Koehring Co.
3026 W. Concordia Ave., Milwaukee 16, Wis.
Excavating, Hauling and Concrete Equipment

Kraft Bag Corp.
630 Fifth Ave., New York 20, N. Y.
Heavy Duty Multiwall Paper Bags

Le Roi Co.
Cleveland Rock Drill Division
12500 Berea Rd., Cleveland 11, Ohio
Air Compressors—Portable 60 Cfm. to 600 Cfm. Gas or Diesel; Tractairs—Combined Tractor with 105 Cfm. Air Compressor; Engines; Generator Sets; Rock and Wagon Drills; Jumbo Drill Rigs, Drifters, Stopers, Self Propelled Drill Rigs

Link-Belt Co.
300 West Pershing Road, Chicago 9, Ill.
Complete Stone Preparation Plants; Conveyors, Elevators, Screens, Washing Equipment, Speed-O-Matic Shovels—Cranes—Draglines and Power Transmission Equipment

Ludlow-Saylor Wire Co.
634 S. Newstead Ave., St. Louis 10, Mo.
Woven Wire Screens and Wire Cloth of Super-Loy, All Commercial Alloys and Metals

Mack Manufacturing Corp.
350 Fifth Ave., New York 1, N. Y.
On- and Off-Highway Trucks, Tractor Trailers, Six-Wheelers, from 5 to 30 Tons Capacity, both Gasoline- and Diesel-Powered

Marion Power Shovel Co.
617 W. Center St., Marion, Ohio
A Complete Line of Power Shovels, Draglines, and Cranes

Marsh, E. F., Engineering Co.
4324 W. Clayton Ave., St. Louis 10, Mo.
Plant Design, Engineering Service, Complete Pit and Quarry Equipment

McLanahan & Stone Corp.
200 Wall St., Hollidaysburg, Pa.
Complete Pit, Mine, and Quarry Equipment —Crushers, Washers, Screens, Feeders, etc.

Michigan Power Shovel Co.
270 Miller St., Benton Harbor, Mich.
Truck Mounted and Crawler Shovel Crane 3/8 and 1/2 Cu. Yd.

Murphy Diesel Co.
5317 W. Burnham St., Milwaukee 14, Wis.
Murphy Diesel Engines Ranging from 90 to 190 Continuous Horsepower at 1200 Rpm. and Packaged Type Generator Sets 60 to 133 Kw. for All Classes of Service

Nordberg Mfg. Co.
3073 S. Chase Ave., Milwaukee 7, Wis.
Cone, Gyratory, Jaw and Impact Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens; Grizzlies; Diesel and Steam Engines; Compressors; Mine Hoists; Track Maintenance Tools

Northern Blower Co.
6409 Barberton Ave., Cleveland 2, Ohio
Dust Collecting Systems, Fans—Exhaust and Blower

Northwest Engineering Co.
135 S. LaSalle St., Chicago 3, Ill.
Shovels, Cranes, Draglines, Pullshovels

Olin Industries, Inc.
Explosives Division
East Alton, Ill.
Dynamite, Black Powder, Blasting Caps, Blasting Supplies

Osgood Co.
Cheney Ave., Marion, Ohio
Power Shovels, Cranes, Draglines, Hoes, Etc., 3/8 to 2 1/2 Cu. Yd.

Pennsylvania Crusher Co.
Liberty Trust Bldg., Broad and Arch Sts., Philadelphia 7, Pa.
Single Roll Crushers, Impactors, Hammermills, Ring Type Granulators, KUE-KEN Jaw Crushers, KUE-KEN Gyracones, Dixie Non-Clog and Standard Hammermills

Pettibone Mulliken Corp.
4710 W. Division St., Chicago 51, Ill.
Buckets, Dragline and Parts; Loaders—Car, Bucket; Plants—Asphalt, Portable

Pioneer Engineering Works, Inc.
1515 Central Ave., N. E., Minneapolis 13, Minn.
Jaw Crushers, Roll Crushers (Twin and Triple), Vibrating and Revolving Screens, Feeders (Mechanical, Grizzly, Apron, and Pioneer-Oro), Belt Conveyors, Portable and Stationary Crushing and Screening Plants, Washing Plants, Mining Equipment, Cement and Lime Equipment, Asphalt Plants

Pit and Quarry Publications
431 S. Dearborn St., Chicago 5, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Concrete Manufacturer, Concrete Industries Yearbook

Quaker Rubber Corp.
Tacony and Milnor Sts., Philadelphia 24, Pa.
Conveyor Belts, Hose, and Packings

Manufacturers Division—National Crushed Stone Association
(concluded)

Rock Bit Sales and Service Co.
350 Depot St., Asheville, N. C.
Tungsten Carbide Detachable Bits, "Rock Bit" Drill Steel Inlaid with Tungsten Carbide, Carbon Hollow Drill Steel, Alloy Hollow Drill Steel

Rock Products
309 West Jackson Blvd., Chicago 6, Ill.

Roebling's, John A., Sons Co.
Woven Wire Fabrics Division
P. O. Box D, Roebling, N. J.
Aggregate Screen, Hardware and Industrial Wire Cloth, Insect Screening, Wire Rope, Fittings and Strand, Slings, Suspension Bridges and Cables, Aerial Wire Rope Systems, Ski Lifts, Electric Wire and Cable, Magnet Wire

Sanderson-Cyclone Drill Co.
South Main St., Orrville, Ohio
All Steel Wire Line, Air Speed Spudders, Large Blast Hole Drills, Drilling Tools and Drilling Supplies

Schield Bantam Co.
Waverly, Iowa
Bantam Trench Hoes, Draglines, Clams, Shovels

Screen Equipment Co.
1754 Walden Ave., Buffalo 25, N. Y.
SECO Vibrating Screens

Shaped Charge Explosive Manufacturers, Inc.
P. O. Box 900, Martinsburg, W. Va.
Shaped Charge Explosives for Industrial Rock Reduction

Simplicity Engineering Co.
Durand, Mich.
Simplicity Gyrating Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

SKF Industries, Inc.
Front St. and Erie Ave., P. O. Box 6731, Philadelphia 32, Pa.
Anti-Friction Bearings—Self-Aligning Ball, Single Row Deep Groove Ball, Angular Contact Ball, Double Row Deep Groove Ball, Spherical Roller, Cylindrical Roller, Ball Thrust, Spherical Roller Thrust; Pillow Block and Flanged Housings—Ball and Roller

Smith Engineering Works
532 E. Capitol Drive, Milwaukee 12, Wis.
Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

Stedman Foundry & Machine Co., Inc.
Aurora, Ind.
Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Limestone Pulverizers

Stephens-Adamson Mfg. Co.
Aurora, Ill.
Belt Conveyors, Elevators, Feeders, Car Pullers, Screens, Skip Hoists, Complete Plants

Talcott, W. O. & M. W., Inc.
91 Sabin St., Providence 1, R. I.
Belt Fasteners, Belt Lacing, Conveyor Belt Fasteners, and Patch Fasteners

Taylor-Wharton Iron & Steel Co.
High Bridge, N. J.
Manganese and other Special Alloy Steel Castings; Dipper Teeth, Fronts and Lips; Crawler Treads; Jaw and Cheek Plates; Mantles and Concaves; Pulverizer Hammers and Liners; Asphalt Mixer Liners and Tips; Manganese Nickel Steel Welding Rod and Plate

Thew Shovel Co.
East 28th St. and Fulton Rd., Lorain, Ohio
Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes, Draglines, Diesel Electric, Gasoline, 3/8 to 2 1/2 Cu. Yd. Capacities

Torrington Co.
Bantam Bearings Division
3702 W. Sample St., South Bend 21, Ind.
Anti-Fricition Bearings; Roller Bearings: Spherical, Tapered, Straight, Ball, Needle

Traylor Engineering & Mfg. Co.
Allentown, Pa.
Stone Crushing, Gravel, Lime, and Cement Machinery

Trojan Powder Co.
17 N. 7th St., Allentown, Pa.
Explosives and Blasting Supplies

Tyler, W. S., Co.
3615 Superior Ave., N. E., Cleveland 14, Ohio
Woven Wire Screens; Ty-Rock, Tyler-Niagara and Ty-Rocket (Mechanically Vibrated) Screens; Hum-mer Electric Screens; Ro-Tap Testing Sieve Shakers and Tyler Standard Screen Scale Sieves

Universal Engineering Corp.
625 C Ave., N. W., Cedar Rapids, Iowa.
Jaw Crushers, Roll Crushers, Hammermills, Complete Crushing, Screening, and Loading Plants, Either Stationary or Portable for Stone Aggregates or Aglime

Vibration Measurement Engineers
7665 Sheridan Rd., Chicago 26, Ill.
Specialists in Blasting Complaint Investigations; Seismological Surveying; Expert Testimony in Blasting Litigation

White Motor Co.
842 E. 79th St., Cleveland 1, Ohio
On- and Off-Highway Trucks and Tractors—Gasoline- and Diesel-Powered; Industrial Engines, Power Units, Axles, Special Machine Assemblies; All Classes of Service

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